

Research Highlights

The secrets of straight growth of plant cells, NEK6 protein aligns cytoskeleton.

Plants continuously generate various kinds of organs such as roots, leaves, and flowers. The growth morphology of each organ is achieved by the directional growth of plant cells. Prior to cell growth, an intracellular cytoskeleton called “microtubule” aligns perpendicular to the growth axis to determine growth direction of plant cells (Fig. 1). Various proteins have been shown to regulate the dynamic behavior of microtubules, however, the mechanism of microtubule alignment remains to be resolved.

Now, Hiroyasu Motose, Shogo Takatani, Taku Takahashi, and their colleagues at Okayama University and NAIST have revealed the function of NIMA-related kinase 6 (NEK6) in the straight growth of plant cells. They employed live cell imaging to investigate dynamic behavior of microtubules and NEK6 proteins in combination with the advantage of genetic analyses in the model plant *Arabidopsis thaliana*.

The results showed that NEK6 protein removes aberrant microtubules to align them before directional cell growth (Fig. 2). NEK6 phosphorylates specific amino-acid residues of tubulin proteins—the building blocks of microtubules—and eliminates abnormal microtubules. In the absence of NEK6, microtubules are crooked and plant cells cannot grow straight (Fig. 3). This study clearly demonstrates novel regulatory mechanism of microtubule organization and directional growth in plants. Since microtubules and NEK proteins are well conserved in most organisms and participate in the essential cellular processes (e.g. cell division) and various diseases (e.g. cancers and ciliopathy), our findings shed new lights on the principles in these biological phenomena.

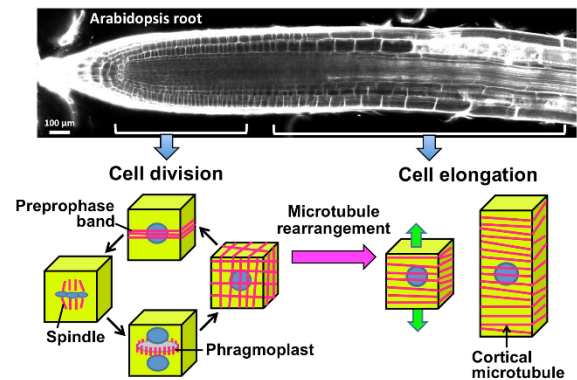


Figure 1. Microtubules (red lines) regulate cell division and expansion.

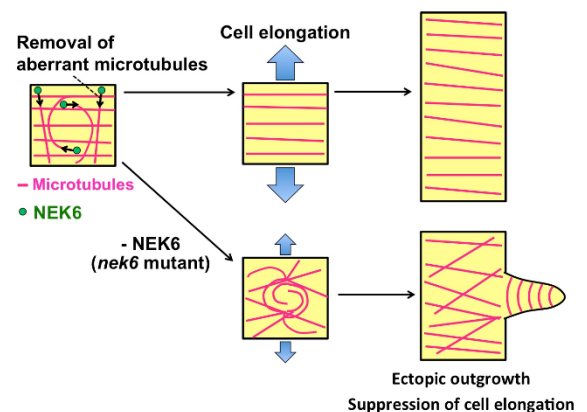


Figure 2. NEK6 removes aberrant microtubules to align microtubules.

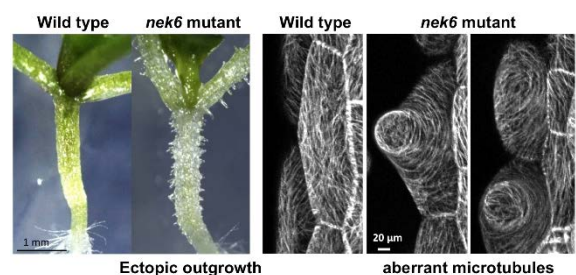


Figure 3. *Arabidopsis nek6* mutant exhibits ectopic outgrowth and aberrant microtubules.

Reference

Authors

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